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DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO

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<p>16. Abstract</p> <p>Although turbidity plumes in Lake Ontario are usually not visible during the winter, meteorologic and hydrologic events may combine to ensure their detection. The clearly defined Niagara River plume of January 25, 1974, was the result of turbid water entering the river at its source near the eastern end of Lake Erie. A persistent southwest wind and mild temperatures resulted in a pile-up of ice free but turbid water at the source of the Niagara River where the highly colored water entered the river. Upon discharge into Lake Ontario, the Niagara River water appears several shades lighter in tone than the ambient lake water (image No. 1551-15315-5).</p> <p>On February 12, 1974, eastward moving ice floes along the Ontario shoreline were forced to move around the hydraulic barrier created by the Niagara River jet. As a result the Niagara River plume was clearly portrayed by a halo-like band of slush ice borne by wind-driven nearshore currents (image No. 1569-15310-4-5).</p>			
17. Key Words Suggested by Author Turbidity plumes Suspended sediment Lake dynamics Shore erosion		18. Distribution Statement	
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TYPE II PROGRESS REPORT
ERTS-1

a. DYNAMICS OF SUSPENDED SEDIMENT PLUMES IN LAKE ONTARIO

ERTS-1 Proposal No.: 342-4D

b. GSFC ID No. : IN 058

c. Statement and explanation of any problems that are impeding the progress of the investigation:

None.

d. Discussion of the accomplishments during the reporting period and those planned for the next reporting period:

A final visit was made to the Stanford Research Institute May 7-10, 1974. All available images through February 1974 were processed on the ESIAC console. Plume sketches at varying scales, photographs, and radiance values of selected turbidity features were obtained.

Ground-truth measurements of wind speed, lake turbidity, temperature, and suspended sediment concentrations were made along the south shore of Lake Ontario April 23-25.

e. Discussion of significant scientific results and their relationship to practical applications or operational problems including cost benefits of any significant results:

Turbidity plumes are rarely visible in Lake Ontario during the winter. Frozen ground, snow cover, shoreline ice, and minimal construction and agricultural activities reduces the opportunity for soil erosion and sediment transport. Moreover, the probability of intense rainstorm occurring during the cold season is small, thereby diminishing the erosive potential of such storms.

The absence of turbidity plumes during the winter was well documented in an unusually successful sequence of images obtained February 10-12, 1974. Useful imagery of the south shore of Lake Ontario was obtained on 3 successive days at a time when sky cover over the area normally approaches complete coverage. Images of the Oswego River (February 10), Genesee River (February 10), the Welland Canal (February 11, 12), and the Niagara River (February 11) shows no evidence of plumes, however faint.

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Under favorable meteorologic conditions, the position of turbidity plumes in winter may be detected in satellite imagery. For example, on February 12, 1974, under the influence of above freezing air temperatures and a southwest breeze, nearshore ice floes were detected moving along the Ontario shoreline toward the Niagara River. Upon reaching the Niagara River mouth, the ice was forced to move away from shore by strong lakeward moving currents. As the Niagara River jet fanned out into the lake and weakened, a persistent eastward trending longshore current forced the ice to move around the hydraulic barrier formed by the jet. The outline of the Niagara River plume, made visible by ice floes, may be seen extending nearly 5 km into Lake Ontario in image No. 1569-15310-4-5.

On January 25, 1974 (image No. 1551-15313-5), a large well-defined plume was visible at the mouth of the Niagara River. The Niagara River plume extended nearly 6 km offshore and was visible nearly 50 km downwind along the New York State shoreline. The unusually high turbidity of the Niagara River at that time probably resulted from excessive turbidity in Lake Erie. Under the influence of persistent southwesterly winds, a pile-up of highly turbid water occurred at the eastern end of Lake Erie. The source of the Niagara River is at the extreme eastern end of Lake Erie, accordingly some of the turbid lake water was swept into the river. Upon discharge into Lake Ontario, Niagara River water appears several shades lighter (more turbid) in the image than the ambient lake waters.

- f. A listing of published articles, and/or papers, preprints, in-house reports, abstracts of talks, that were released during the reporting period:

A paper "Dynamics of Suspended Sediment Plumes" were submitted to the Survey's EROS unit for publication as part of an ERTS book.

- g. Recommendations concerning practical changes in operations, additional investigative effort, correlations of effect and/or results as related to a maximum utilization of the ERTS system:

None.

- h. A listing by date of any change in Standing Order Forms:

None.

- i. ERTS Image Descriptor Forms:

Will be completed as part of the final report in January 1975.

- j. Listing by date of any changed Data Request forms submitted to Goddard Space Flight Center/NDPF during the reporting period:

None.